Technology for placing cargo into orbit based on magnetic levitation

Berhulov A.S.

Kyiv Mechanics Institute named after S.P.Timoshenko, PhD

Abstract

The article provides a technology of placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field. A method for the implementation of Tsiolkovsky's space elevator using magnetic levitation in the Earth's magnetic field is proposed.

Keywords

Earth electromagnetic fields; Magnetic levitation; Lorentz force; Surface charge redistribution; Placing cargo into orbit; Space elevator;

The problem of space exploration is relevant in view of building an advanced technological society and the resolution of socio-demographic problems on the planet. This article proposes a method for placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field, as well as a method for placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field. Previously, a similar solution was given in [1,2].

Solution method

According to [4], the Earth has a magnetic field with induction $3\times10^{-5}T$ (this is an average value, it differs slightly in different places on the planet). The magnetic field lines leave the north magnetic pole and enter the south magnetic pole, at the magnetic equator they are parallel to the surface of the planet.

The idea of placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field using the Lorentz force arises.

Let us consider the construction [*Fig. 1*]:

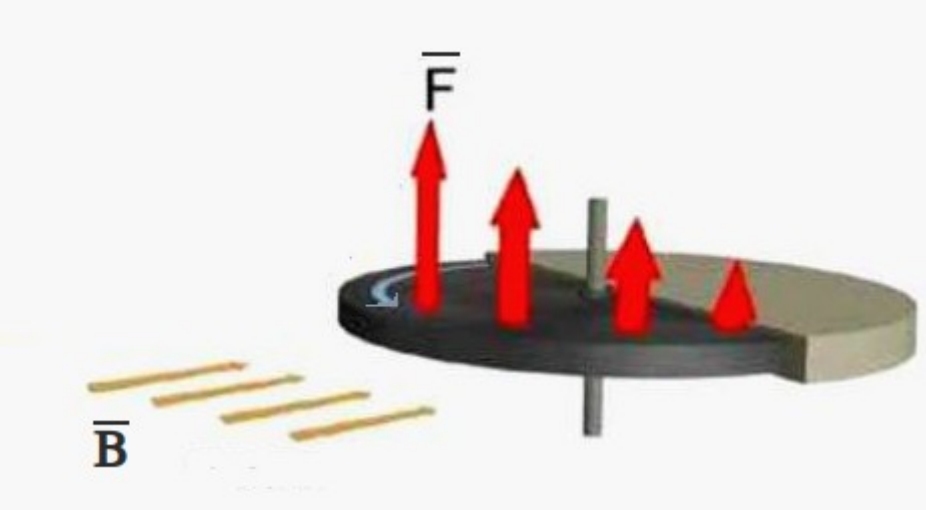

Fig. 1.

In *Fig. 1*: The lines of the magnetic induction vector B are parallel to the surface of the planet, the rotating disk with a charge and a ferromagnetic casing on it are also parallel to the surface. The disk turns “towards us", the flat side of the casing is orthogonal to the lines of magnetic induction. Then due to the rotation of the disk we obtain a non-zero Lorentz force directed upward, which can be calculated by the formula [3]:

$$F_L = q(E + [v \times B])$$

Here: q is the total charge on the surface free of the casing, E is the electric component (let's take it conventionally equal to zero), v is the averaged speed of rotation of points on the disk surface, and B is the magnetic field induction.

To stabilize the entire structure, 2 symmetrical disks with casings should be taken, as shown in *Fig. 2*:

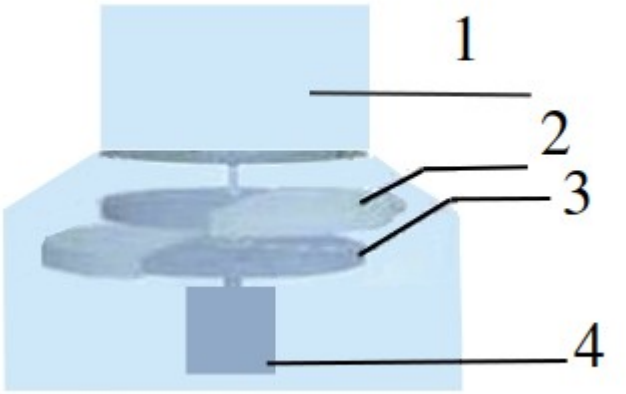

Fig. 2.

Fig. 2: 1 – cargo and/or astronaut compartment, 2,3-rotating disks with casings, 4-engine.

Then, assuming that the mass of 2 disks with casings is 200 kilograms, the mass of the whole structure is 1000 kilograms, rotation speed of disks is 100 revolutions per second, diameter of disks is 3 meters, we have the necessary charge on the surface to ensure levitation of the whole structure in the Earth's magnetic field:

$$q=\frac{mg}{[v\times B]}=\frac{10000}{100*3*3.1415*3*0.00001}Coulomb=353688\,Coulomb$$

And it is possible to obtain such a charge, basically. For example:

- The ionistors used in a modern uninterruptible power support system for powerful frequency converters permanently store approximately 18 MJ of energy (36 kilocoulombs);
- The battery of a car with a hybrid drive stores a charge of approximately 50 kWh (360 kilocoulombs)

By slightly increasing the charge, we obtain the lifting force, which will make it possible to place the structure into the Earth's orbit.

It should also be noted that this technology can be used for the practical implementation of Tsiolkovsky's idea of a space elevator. For example, each of the 1,000-kilogram elevator sections can be equipped with four disks with casings, as shown in *Fig. 3*. The total weight of

the disks with the engines is 400 kilograms and another 600 kilograms will be used for the construction of the elevator itself.

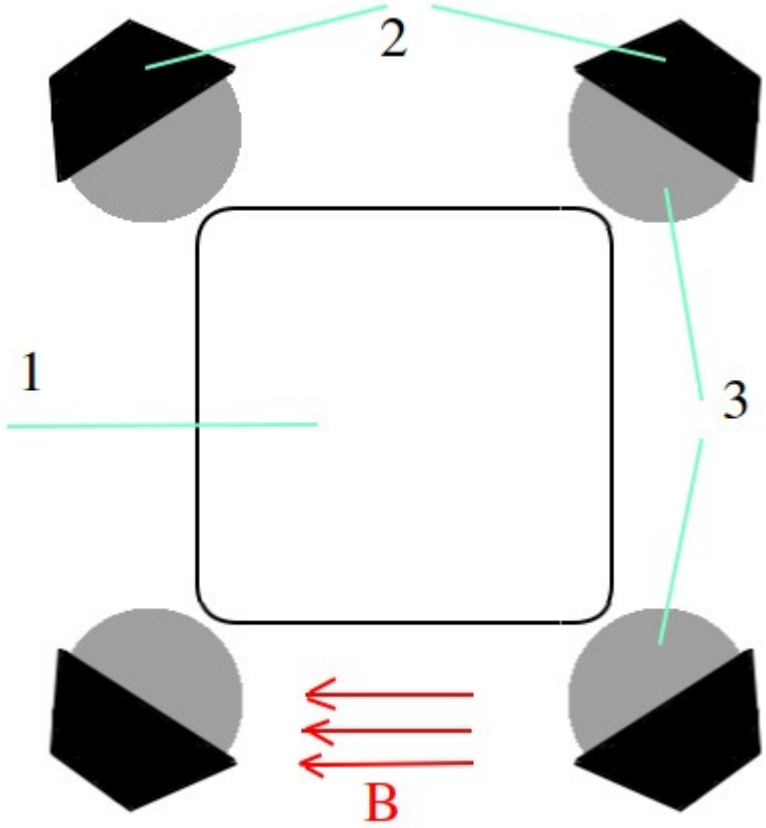

Fig. 3.

In *Fig. 3*: 1 - elevator shaft, 2 - casings, 3 - disks with a charge. The magnetic field induction lines are marked in red.

In a similar way we can apparently make structures of arbitrary shape and weight levitate, even up to flying cities like in the movie "Alita: Battle Angel".

Conclusions

This article proposes a method for placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field, as well as a method for placing cargo into orbit at middle and equatorial latitudes based on magnetic levitation in the Earth's magnetic field. Such a way of placing into orbit could become a cheaper substitute for launch vehicles due to its technological simplicity, as well as relieve astronauts from excessive overloads.

References

1. Бергулев А.С. (Bergulev A.S.) Магнитный двигатель для космоса (полная версия) // Международный научный журнал "Интернаука". — 2021. — №1. (Magnetic engine for Space (full version) // International scientific journal "Internauka". — 2021. - No. https://doi.org/10.25313/2520-2057-2021-1-6839
2. Бергулев А.С. (Bergulev A.S.) Магнитный двигатель для космоса (полная версия) // Международный научный журнал "Интернаука". — 2020. — №1. (Magnetic engine for Space (full version) // International scientific journal "Internauka". — 2020. - No. https://doi.org/10.25313/2520-2057-2020-1-5520
3. https://en.wikipedia.org/wiki/Lorentz_force
4. Магнитные поля в космосе. (Magnetic fields in space.) Изд.2, доп. (V.2, amended) Бочкарев Н.Г. 2011 [Magnetic fields in the space. 2nd ed., amend. Bochkariov N.G., 2011]